Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band	)	IB Docket No. 01-185
	)	
Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service	)	ET Docket No. 95-18

To: The Commission

SUPPLEMENTAL COMMENTS OF ICO GLOBAL COMMUNICATIONS

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ICO Global Communications (Holdings) Ltd. ("ICO")[1] submits these supplemental comments in response to the Public Notice in the above-captioned proceeding seeking additional information regarding the severability of terrestrial operations from mobile satellite service ("MSS") operations in the 2 GHz band, L-band, and Big LEO bands.[2]

Severing terrestrial operations from satellite operations in the 2 GHz MSS band would so seriously compromise MSS as to render it infeasible. Specifically, independent terrestrial operations would (1) create large exclusion zones inaccessible to terrestrial or satellite users; (2) substantially reduce the amount of capacity available for both satellite and terrestrial services; and (3) freeze technological innovation in the development of satellite equipment and services. In addition, the non-geostationary ("NGSO") architecture of the ICO system further complicates any sharing with independent terrestrial systems. ICO's frequency assignment and interference

[1] ICO, a Delaware corporation, is the parent of ICO Services Limited, a UK company that is authorized to provide 2 GHz mobile satellite service in the United States.

[2] *See* FCC Public Notice, *Commission Staff Invites Technical Comment on the Certain Proposals to Permit Flexibility in the Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band*, DA 02-554 (Mar. 6, 2002). All filings in IB Docket No. 01-185 and ET Docket No. 95-18 will hereinafter be short cited.

management system would be required to account for both the satellites' movement across the earth's surface as well as the movement, within each satellite footprint, of mobile subscribers over whom it would have no control. The constraints of co-frequency sharing between satellite and stand-alone terrestrial systems would jeopardize the ability of 2 GHz MSS operators to provide basic and advanced services, while yielding marginal benefits, if any, for prospective independent terrestrial operators. Accordingly, attempting to accommodate independent terrestrial operations within the 2 GHz MSS band would disserve the public interest. The Commission therefore should authorize 2 GHz MSS operators to integrate an ancillary terrestrial component ("ATC") into their systems without further delay.

I. Band Sharing Is Unworkable

> [*From a purely technical point of view, can the operations of MSS in the 2 GHz band, L-band and Big LEO band be "severed" from terrestrial operations in each band? In other words, is it technically feasible for one operator to provide terrestrial services and another operator to provide satellite services in the same MSS band? If not, why not? Parties should specifically address any band-specific rules, orders or agreements that might pose additional technical obstacles to severing terrestrial and satellite operations.*]

As ICO repeatedly has demonstrated, band sharing between MSS and terrestrial operations requires complex coordination between the two operations and dynamic management of spectrum that could be accomplished only by a single operator.[3] Absent integration of these operations by a single operator, an independent terrestrial system could accommodate only a very limited number of handsets before causing interference to co-frequency 2 GHz MSS systems. The significant potential for interference between MSS and terrestrial services would render band sharing technically infeasible with respect to effective and efficient operation of the satellite component. This interference would severely disrupt the satellite component's

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[3] *See* Letter from Lawrence H. Williams *et al.*, ICO, to Chairman Michael K. Powell, FCC (Mar. 8, 2001) ("ICO March 8 *Ex Parte*"); Comments of ICO (Oct. 22, 2001); Reply Comments of ICO (Nov. 13, 2001).

capability to offer additional advanced features such as Global Positioning System functions, in addition to basic transmission functions.

As discussed below, the dynamic frequency assignment employed by ICO's non-geostationary, medium earth orbit ("MEO") constellation enable it to integrate a complementary ATC into its existing architecture. This same feature, however, render the task of coordinating frequency use with and mitigating interference from independent terrestrial systems virtually impossible.

A. Independent Terrestrial Operators Are Unable to Effectively Coordinate Spectrum Use With 2 GHz MSS Incumbents

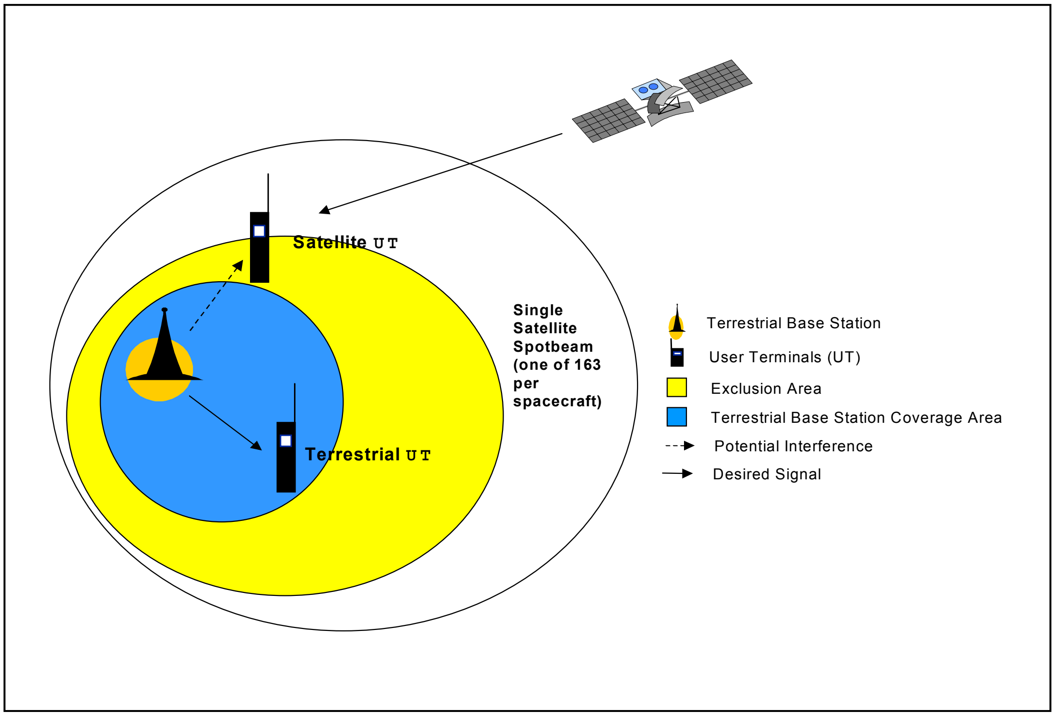
When 2 GHz frequencies are not managed by a single entity, but are shared between stand-alone terrestrial mobile and 2 GHz MSS systems, each co-frequency system will suffer severe interference and will be substantially limited in the amount of traffic that it can carry.

1. Potential Interference in the 2 GHz MSS Downlink Band

As Figure 1 illustrates below, a stand-alone terrestrial base station operating in the 2 GHz MSS downlink band at full power will create an exclusion zone of approximately 32 kilometers in radius, within which co-frequency satellite user terminals ("UTs") would suffer unacceptable interference in attempting to access a relatively weaker satellite signal.[4]

[4] *See* Comments of ICO at 32. The interference scenarios depicted in Figures 1, 2, and 3 assume that the terrestrial system is operating in a forward band sharing mode (i.e., terrestrial base stations transmit in the MSS downlink, and terrestrial UTs transmit in the MSS uplink). Similar results, however, would be obtained if the terrestrial system operates in other sharing modes such as reverse band, downlink duplex, and uplink duplex sharing modes.

Figure 1: Potential Interference in the 2 GHz MSS Downlink



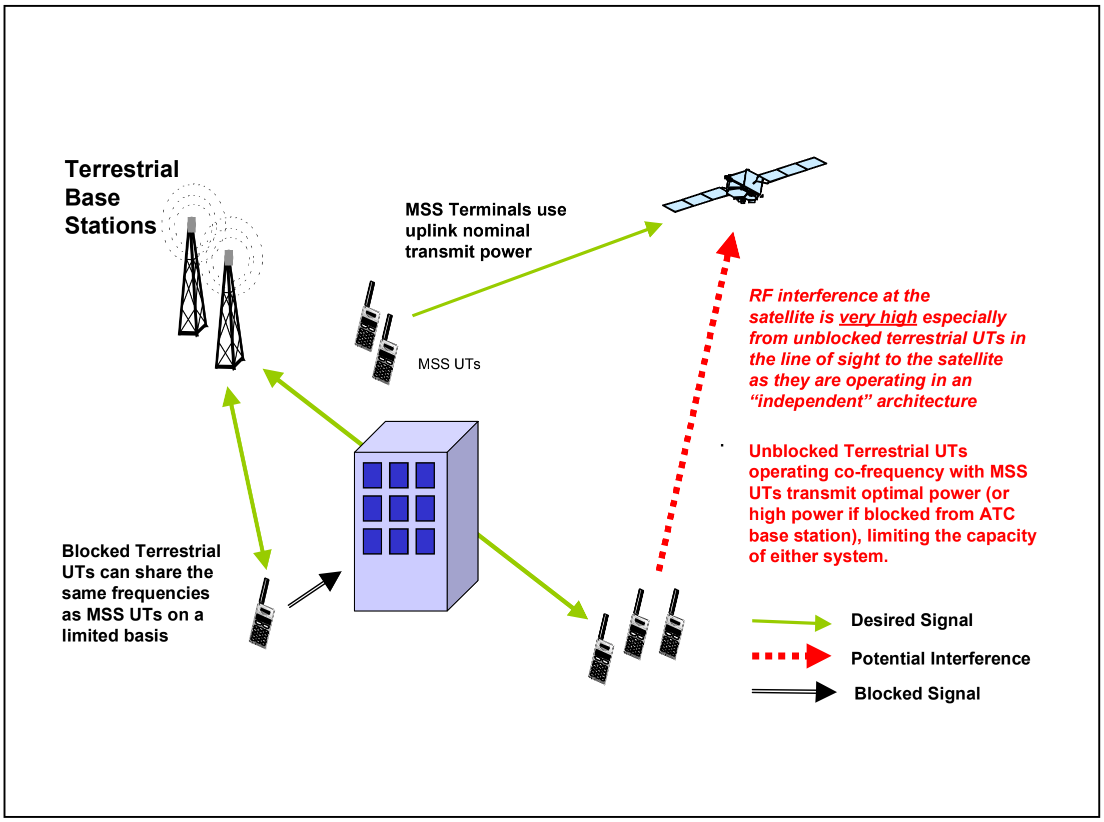
Within the exclusion zone, satellite UTs simply cannot share the same frequencies at the same time with the terrestrial base station. Unlike an ATC-integrated MSS operator, a stand-alone terrestrial operator is incapable of dynamically managing spectrum use in order to accommodate satellite UTs within the exclusion zone.

2. Potential Interference in the 2 GHz MSS Uplink Band

Terrestrial operations in the 2 GHz MSS uplink band present another challenging interference scenario. Specifically, a stand-alone terrestrial system operating in the 2 GHz MSS uplink band could accommodate only a very limited number of terrestrial UTs within a given spot beam before causing unmanageable levels of interference to co-frequency 2 GHz MSS signals.[5] Therefore, if the stand-alone terrestrial operator were permitted to share 2 GHz MSS spectrum on a co-primary or secondary basis with 2 GHz MSS incumbents, it would need to restrict its operation to this limited number of terrestrial UTs in order to protect co-frequency 2 GHz MSS from harmful interference. This severely restricted operation would be grossly inadequate to support a commercially viable service.

Figure 2 below illustrates the potential interference caused by a stand-alone terrestrial system, necessitating restrictions on its operations.

Figure 2: Potential Interference in the 2 GHz MSS Uplink



[5] *Id.* app. A.

As Figure 2 shows, terrestrial UTs may operate either within the direct line of sight to an MSS satellite ("unblocked" UTs) or outside the direct line of sight to the satellite ("blocked" UTs). Unblocked UTs operating in the 2 GHz MSS uplink produce signals intended for reception within the terrestrial system, but which also reach the MSS satellite at aggregate interference levels comparable to signals from MSS UTs. As a result, the unblocked UTs could interfere with co-frequency transmissions from MSS UTs to the satellite. The stand-alone terrestrial operator has no real-time mechanism to mitigate this interference by limiting the number of terrestrial UTs on specific frequencies in real time.

Blocked terrestrial UTs would cause a modest level of interference to satellite reception because their signals levels are much lower at the satellite. Their interference contributions, however, would be in addition to much higher levels of interference that already accrue from the unblocked terrestrial UT transmissions. A stand-alone terrestrial operator, lacking real-time information about the operations of co-frequency MSS systems, must assume worst-case conditions for maintaining the quality of its transmissions in anticipation of potential interference from the co-frequency MSS UTs. Under these worst-case conditions, the aggregate amount of interference from terrestrial UTs could be maintained at a tolerable level only by severely limiting the number of terrestrial UTs that could be shared on a co-frequency basis with MSS UTs within a given spot beam. Consequently, this restricted operation would limit the capacity of the stand-alone terrestrial system to marginal levels and would not likely support a commercially viable service.

B. Only an ATC-Integrated 2 GHz MSS Operator Can Dynamically Manage Co-Frequency Satellite and Terrestrial Operations

The goal of any effective management of co-frequency satellite and terrestrial operations is to provide adequate interference mitigation, or, in other words, the ability to achieve maximum system capacity for each operation without unacceptable signal degradation for either. ICO's proposed ATC-integrated MSS system has the unique ability to maximize overall system capacity by coordinating both satellite and terrestrial components and by dynamically managing the use of spectrum by each component.

1. The ICO System Has the Basic Mechanism in Place to Accommodate ATC Operations

In order to appreciate the unique capability of the ICO system to coordinate co-frequency satellite and ATC operations, one must first understand certain basic operations of the satellite component of the ICO system. The 12-satellite non-geostationary constellation operates in MEO in two orbital planes, each at a 45-degree inclination. The satellites have the capability to tune across the 2 GHz MSS band. Each satellite transmits into and receives from a satellite footprint, which has a diameter of approximately 15,000 kilometers. There are 163 spot beams on each satellite, permitting a maximum four-fold re-use of assigned frequencies within this footprint. The spot beams have footprints ranging in diameter from 600 to 1,500 kilometers depending upon the angle at which the particular spot beam hits the earth.

An ICO MSS user places a call by communicating directly with a satellite in the 2 GHz MSS uplink band. The satellite receives the customer's call request and re-transmits it to one of 11 gateway earth stations, or satellite access nodes ("SANs"), using feeder link frequencies in the 7 GHz band.

At the SAN, the customer's signal is demodulated, decoded, and routed toward its final destination. Transmissions in the opposite direction (i.e., from the called location to the customer) are routed to the appropriate SAN, which then transmits the signal to the satellite, using feeder link frequencies in the 5 GHz band. The satellite then re-transmits the signal on 2 GHz MSS downlink frequencies to the customer.

The SANs, together with the fiber optic facilities that interconnect them, comprise the ground segment. ICO relies on its ground segment to perform the complex signal processing required to demodulate and decode the signal, as well as to determine the optimal frequency assignment for user terminals and the selected route of the signal.

To maximize capacity within its 12-satellite constellation, ICO employs frequency re-use within non-adjacent spot beams, assigning different frequencies to adjacent spot beams. ICO spot beams move at approximately 1 degree (or 100 kilometers on the Earth's surface) per minute with respect to a given stationary point on the ground. Because the spot beams move (as do the satellites) with respect to a user at a particular location on the ground, frequency assignments to customer handsets accessing the satellites must be changed constantly. ICO accordingly relies on a very sophisticated frequency assignment system to provide dynamic spectrum planning and allocation for mobile operations accessing the non-geostationary, MEO constellation.

In order to manage its spectrum under these constraints, ICO has developed, constructed, and installed a system to produce frequency allocation plans that vary minute-by-minute, tracking its satellites' movement through their six-hour orbits. This system, known as the Satellite Resource Management System ("SRMS"), maps frequency use for ICO satellites as well as for its gateway earth stations, or SANs. The SANs in turn assign specific frequencies to user terminals for transmission and reception.[6]

The time-varying spectrum resource plans generated for each prescribed geographic area, or "ground cell," must take into account a number of system constraints. These include the global frequency allocations for each ground cell; the frequency spot beam re-use patterns within a given satellite's footprint; satellite field-of-view constraints (i.e., satellites in view of a given SAN) as a function of time; available frequencies; traffic demands within a given footprint and throughout the constellation; moving satellites and spot beams; overlapping spot beam coverage areas; limitations on satellite transmitting power; and availability of satellite channel filters. Within these constraints, the system is designed to consider additional parameters, such as signal strength or desired bit error rates, in making channel assignments and granting call requests. All

[6] The SRMS was developed over a five-year period and is now installed. Over 500,000 lines of new computer code on a suite of HP-9000/K370 servers, located at ICO headquarters in Uxbridge, UK, control the system.

of these factors must be evaluated on a real-time basis in order to enable the ICO system to dynamically allocate spectrum resources to its globally dispersed mobile users.

2. The ICO Dynamic Resource Management System Is Uniquely Suited to Accommodate ATC Operations

With certain modifications to its existing SRMS, ICO can add an ancillary terrestrial component to its system and provide for efficient spectrum sharing by both terrestrial and satellite components. ICO would use a centralized Dynamic Resource Management System ("DRMS"), which is a modified version of its existing SRMS, to manage spectrum resources in order to accommodate changing traffic demands and other system variables such as interference thresholds and available frequencies for a given area. Specifically, ICO could use DRMS to implement traffic management measures, such as the carrier on/off method and the admission control method.[7]

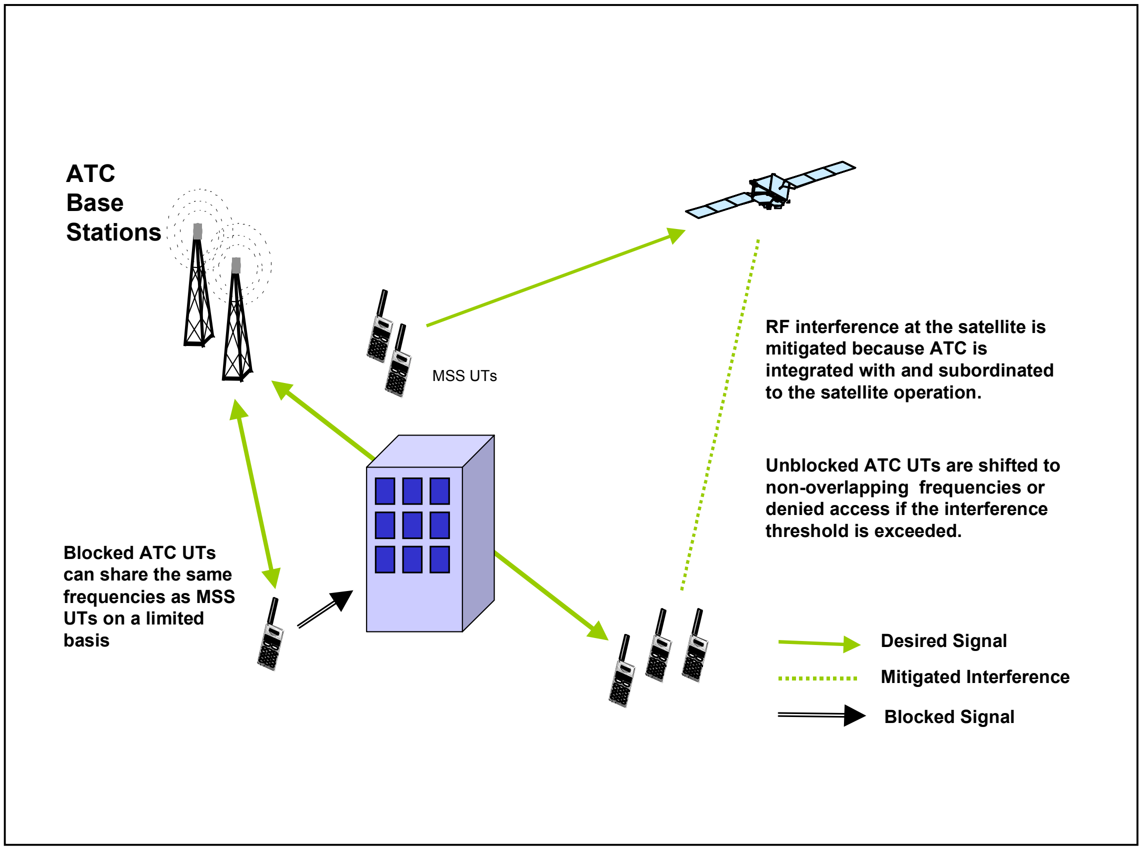
Under the carrier on/off method, ICO could dynamically allocate spectrum between the satellite and terrestrial components to adjust for changes in traffic demand for each component. Thus, for example, as ATC traffic decreases relative to satellite traffic, the spectrum available for ATC use would be reduced and made available for satellite use.

Under the admission control method, ICO could manage spectrum sharing by monitoring the interference threshold on available frequencies (i.e., monitoring in real time the actual bit-error rate on individual MSS channels). Once ATC use reaches the interference threshold, ICO could assign non-overlapping spectrum to the additional ATC use or temporarily deny access for that use if no alternative, non-overlapping spectrum is available.

Figure 3 below illustrates how ICO's ATC-integrated system can eliminate interference that otherwise could not be mitigated by a stand-alone terrestrial system.

[7] *See* Comments of ICO app. B at 5-6.

Figure 3: Interference Mitigation in 2 GHz MSS Uplink by ATC



As Figure 3 shows, although unblocked ATC UTs operating in the 2 GHz MSS uplink are intended to transmit to the ATC base station, they also have a clear, line-of-sight path illuminating the satellite and thus could jam co-frequency transmissions from MSS UTs to the satellite. As described above, the ICO DRMS can effectively mitigate interference caused by ATC UTs by (1) assigning non-overlapping frequencies to the ATC UTs, or (2) denying spectrum access to the ATC UTs, as necessary. The commands to regulate these ATC UT frequency and service allocations would be generated at the DRMS and sent to the Terrestrial Network Element Manager, which in turn would relay them to the ATC UTs via the ATC base station.

The allocation of available non-overlapping frequencies for ATC use would occur only after available frequencies have been allocated for the satellite component. This arises from the fact that, as discussed in Section I(B)(1) above, the satellite component relies on a sophisticated frequency assignment system, which constantly changes the frequency assignments for MSS UTs as the satellites move over the ground. As a result, the allocation of available non-overlapping frequencies for ATC use must be performed within this constraint imposed by the satellite operation (i.e., after frequencies have been allocated for the satellite component) and therefore is subordinate to the demands of the satellite operation.

Blocked ATC UTs, on the other hand, are effectively shadowed or "blocked" from illuminating the MSS satellite. These ATC UTs could operate without excessive interference to co-frequency MSS UTs, since their signals will experience significant attenuation losses and will be received at levels much lower than unblocked MSS signals arriving at the satellite in the same spot beam.

The operational measures employed by ICO, as outlined above, would not be available to a stand-alone terrestrial operator. Each of these methods relies upon ICO's full knowledge of all satellite and terrestrial activity on its network in order to make real-time adjustments to accommodate continuously changing operating conditions. Consequently, ICO could effectively use DRMS to optimize spectrum use and provide for efficient spectrum sharing between the terrestrial and satellite components.

Under a severed approach, MSS systems would be forced to manage frequency coordination with multiple stand-alone terrestrial operations across the United States. This arrangement could not replicate the efficiencies of an ICO ATC-integrated MSS system. The added burden of anticipating and calculating the impact of the demands of these terrestrial systems on the satellite system, rather than maximizing capacity for both systems, would substantially reduce the amount of capacity and coverage available to each system.

C. Commission Precedent Recognizes That Band Sharing Between MSS and Terrestrial Mobile Services Is Infeasible

The Commission itself has recognized that frequency sharing between MSS and terrestrial operations presents virtually insurmountable obstacles. In the *MMDS/ITFS Flexibility*

Order, for example, the Commission rejected a proposal that would allow MSS to share frequencies in the 2.5 GHz band with terrestrial mobile and fixed services, finding that "sharing between terrestrial and satellite systems would present substantial technical challenges."[8] The Commission noted the lack of any technical criteria demonstrating the feasibility of sharing between MSS and terrestrial mobile and fixed services in the 2.5 GHz band. The Commission concluded that the geographic areas where MSS might be able to share with incumbent Instructional Television Fixed Service and Multichannel Multipoint Distribution Service systems were "quite limited," given the deployment of those systems in both rural and urban areas.[9] Notably, the Commission found that the possibility of the shared use of the band by MSS is "sharply diminished" by the introduction of terrestrial mobile services in the 2.5 GHz band.[10]

Even with respect to infinitely less complex sharing situations involving fixed satellite and fixed terrestrial services, the Commission has repeatedly rejected such sharing, finding that the ubiquitous deployment of these systems renders it impractical to coordinate these independent operations. For example, the Commission has rejected sharing between FSS and terrestrial Local Multipoint Distribution Services ("LMDS"), concluding that "co-frequency sharing between either GSO/FSS or NGSO/FSS ubiquitously deployed subscriber terminals and LMDS with its ubiquitously deployed subscriber terminals is not feasible at this time."[11] Similarly, the Commission has found that the point-to-multipoint nature of terrestrial Digital

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[8] *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems*, 16 FCC Rcd 17222, 17223 ¶ 3 (2001) (*"MMDS/ITFS Flexibility Order*").

[9] *Id.* at 17241 ¶ 35.

[10] *Id.*

[11] *See Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and For Fixed Satellite Services*, First Report and Order and Fourth Notice of Proposed Rulemaking, 11 FCC Rcd 19005, 19015-19016 ¶ 27 (1996).

Electronic Message Service precluded spectrum sharing with government FSS earth stations in the 18.82-18.92 GHz band.[12]

Only in the atypical case—the *MVDDS/DBS Order*—did the Commission, following testing and analysis conducted over several years, find it possible for terrestrial fixed Multichannel Video Distribution and Data Service ("MVDDS") systems to share Direct Broadcast Satellite ("DBS") spectrum only on a non-interference basis.[13] However, the particular characteristics of DBS systems, which are geostationary, and MVDDS systems, which use fixed, highly directional antennas, render the MVDDS/DBS sharing scenario inapposite as precedent for authorizing independent terrestrial mobile systems in 2 GHz MSS spectrum.[14]

Unlike the MVDDS/DBS sharing scenario, which involves nothing more than fixed transmit/receive points and potential interference received at receive-only, directional DBS antennas, sharing between MSS and terrestrial mobile services involves mobile transmit/receive

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[12] *See Amendment of the Commission's Rules to Relocate the Digital Electronic Message Service From the 18 GHz Band to the 24 GHz Band and to Allocate the 24 GHz Band for Fixed Service*, 12 FCC Rcd 3471 (1997). *See also Amendment of the Commission's Rules Regarding the 37.0-38.6 GHz and 38.6-40.0 GHz Bands,* Report and Order and Second Notice of Proposed Rulemaking, 12 FCC Rcd 18600 (1997) (concluding that the types of fixed and satellite services likely to be offered in the 39 GHz band would not be able to share spectrum); *Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz, and 48.2-50.2 GHz Frequency Bands,* Report and Order, 13 FCC Rcd 24649 (1998) (providing separate designations within the 36.0-51.4 GHz band for terrestrial wireless and fixed satellite services because of the difficulty of sharing between those services).

[13] *See Amendment of the Commission's Rules to Authorize Subsidiary Terrestrial Use of the 12.2-12.7 GHz Band by Direct Broadcast Satellite Licensees and Their Affiliates*, 16 FCC Rcd 4096, 4177 ¶ 213 (2000) ("*MVDDS/DBS Order*"). Following its decision to permit sharing, the Commission authorized MITRE Corp., an independent engineering firm, to conduct an analysis to determine whether Northpoint's system could share DBS spectrum without interference to DBS systems. The Commission currently is considering the results of this analysis and extensive comments filed in response to the analysis.

[14] The Commission permitted MVDDS systems to share DBS spectrum only on a non-interference basis, based on a more extensive record than is present here. Northpoint Technology, Ltd., an MVDDS proponent ("Northpoint"), and DBS incumbents offered technical analyses regarding the technical feasibility of band sharing. In particular, Northpoint operated its system under an experimental license and provided test results from its operations at several locations in Texas and Washington, D.C. Northpoint asserted that because receive-only directional DBS antenna dishes are aligned with (*i.e.*, oriented towards) fixed northward-oriented DBS satellite transmissions, they should not receive interference from fixed southward-oriented terrestrial MVDDS transmissions. In other words, because the DBS satellite dishes are always pointed towards and "listening" for transmissions coming from the south, they will not "hear" signals arriving from the north. In this manner, the two transmissions theoretically can occupy identical frequencies at identical times in close proximity without coordination.

points and omnidirectional transmission paths. In addition, because the MSS and terrestrial handsets present a ubiquitous mobile source of interference, interference mitigation cannot be achieved by simply re-positioning those handsets a few feet in one direction or another.

There is no basis in the record to support any band sharing between independent terrestrial mobile and MSS systems. Unlike the *MVDDS/DBS* proceeding, no party in this proceeding has proposed an independent terrestrial system, performed any engineering analysis to demonstrate the feasibility of such a system, or proposed any specific techniques to mitigate interference from an independent terrestrial mobile system to a 2 GHz MSS system. In fact, CTIA has urged the Commission to auction terrestrial rights in a segmented portion of the MSS band, rather than auctioning those rights for shared spectrum, effectively (and correctly) conceding that band sharing between independent terrestrial and 2 GHz MSS systems is not feasible.[15] As difficult as sharing between fixed terrestrial services and fixed or broadcast satellite services often is, co-frequency sharing between independent mobile satellite and mobile terrestrial services introduces insurmountable technical and operational limitations. In fact, there is ample evidence in the record to demonstrate that this type of band sharing is infeasible.[16]

II. Independent Terrestrial Operations in the 2 GHz MSS Band Would Impose Insurmountable Operational and Regulatory Burdens

A. Band Sharing Would Severely Constrain System Capacity and Prevent One or Both Systems from Achieving Commercial Viability

[*Assuming terrestrial and satellite operations can be severed, how would severing the operations affect domestic and foreign satellite operations? terrestrial operations?*]

[15] *See* Letter from Christopher Guttman-McCabe, CTIA, to William F. Caton, Acting Secretary, FCC, Attachment, at 12 (Feb. 27, 2002). Although Iridium has proposed an independent secondary terrestrial service allocation, it neither provided any specific plan to operate any independent terrestrial system in MSS spectrum nor offered any technical analysis demonstrating the feasibility of such a system. *See* Comments of Iridium at 6.

[16] *See* Comments of Globalstar and L/Q Licensee at 14-15; Comments of Globalstar Bondholders at 33-34; Comments of Celsat America at 8; Comments of Constellation Communications at 16.

As discussed in Section I above, band sharing between independent terrestrial mobile and 2 GHz MSS systems would result in harmful interference to one or both systems. In order to protect the other system from interference, each system would be forced to operate under significant technical constraints that effectively would limit the amount of traffic that could be carried. Any attempt to apportion the constraints fairly between the two systems would leave both systems so hamstrung that neither would be commercially viable. Due to the global nature of the 2 GHz MSS allocation and NGSO MSS systems, the effects described above would be replicated for both terrestrial and satellite mobile systems attempting to operate independently in the 2 GHz band in any location within or outside the United States.

B. Severing Satellite and Terrestrial Operations Would Not Permit Either Operator to Provide Viable Service to Rural Areas

> [*Assuming terrestrial and satellite operations can be severed, how would severing the operations affect service to remote and rural areas? To urban areas?*]

Severing terrestrial and satellite operations, with the attendant capacity limitations, would leave rural Americans (and those urban residents who often travel in rural areas) without badly needed service. Satellite services are often the only realistic choice for those in rural and remote areas that are not adequately served by terrestrial networks.

It should be clear, however, that urban coverage is essential to the viability of satellite systems as well as terrestrial systems for a number of reasons. First and foremost, even rural subscribers want their handsets to operate in large cities. If the handsets do not operate in those areas, then the satellite service is less useful to rural residents, and penetration rates may fall below the point of economic viability. Second, if satellite services cannot be made available in urban settings because the Commission decides to license co-frequency terrestrial services there, the number of potential users who could be served by satellite would fall dramatically. It would be uneconomical to launch a satellite system that is devoted exclusively to rural residents who never travel to cities and do not seek services beyond their rural locations.[17]

Hence, any attempt to sever terrestrial and satellite operations would cripple the ability of 2 GHz MSS providers to provide service anywhere. As discussed in Section I(A) above, the obligation to protect against inter-system interference would severely restrict the ability of either or both satellite and terrestrial systems to maximize use of their spectrum and provide service to an optimal number of customers. At the same time, the lack of effective inter-system coordination and ability to assign spectrum dynamically would impose additional capacity constraints on both systems. Because meaningful sharing between the two independently operating systems is for all intents and purposes impossible, neither satellite nor stand-alone terrestrial operation can support any commercially viable service that covers both rural and urban areas. In addition, as discussed in Section II(A) above, 2 GHz MSS operators not only would be unable to use their spectrum to provide ATC to urban areas, but also would be deprived of the economies of scale that would be necessary to sustain service even to rural areas.

C. Independent Terrestrial Operations Would Require Much More Detailed Technical Rules to Prevent Interference Than ATC Operations

[*Assuming terrestrial and satellite operations can be severed, how would the technical requirements for separate services differ from the technical requirements for integrated MSS ATC? How would severing the operations affect adjacent channel operations (both satellite and terrestrial)? What requirements are necessary for an integrated MSS ATC system to avoid adjacent channel and/or adjacent band interference? How do the technical requirements that integrated MSS ATC systems must observe to avoid creating harmful interference differ from those that freestanding terrestrial mobile systems would have to observe?*]

[17] *See* Comments of ICO at 15-21; ICO March 8 *Ex Parte* at 5-6.

1. ATC Does Not Require Strict Interference Rules, Although Additional Rules to Protect Adjacent-Band MSS Operations May Be Warranted

Because an ATC-integrated 2 GHz MSS operator has the incentive and ability to minimize interference from its ATC operations to its own satellite operations, extensive technical requirements are neither required nor warranted. As discussed in Section I(B) above, an ATC-integrated MSS operator can readily implement effective interference mitigation techniques that are not available to independent terrestrial wireless carriers.

In addition, ICO has proposed specific measures designed to eliminate adjacent-band interference from ATC operations.[18] For example, a 2 GHz MSS operator could place dedicated satellite-only channels on the edges of its assigned frequency band, creating adequate guard bands between its ATC operations and the operations of adjacent-band MSS providers. The 2 GHz MSS operator also could modify its ATC hardware to reduce out-of-band ("OOB") emissions, such as providing additional IF and RF filtering, using sufficiently linear amplifiers, and improving local oscillators and LO filters.

With respect to adjacent band operations, Boeing initially raised issues concerning appropriate OOB emission limits. After reviewing this matter, ICO has agreed that additional OOB emission limits will be required to protect against adjacent-band interference from ATC operations.[19] ICO is working closely with Boeing to resolve these issues and is confident that the parties will reach resolution promptly. Accordingly, these limited adjacent-band interference issues are resolvable and should not delay Commission action on authorizing ATC operations.

In contrast, because of the significant potential for interference from independent terrestrial operations to co-frequency 2 GHz MSS systems, specific power limits and other interference mitigation techniques would be required to mitigate interference. To date, no party has demonstrated that any effective mitigation techniques exist to eliminate co-frequency or

[18] *See Ex Parte* Letter from Suzanne Hutchings, Senior Regulatory Counsel, ICO, to William Caton, Acting Secretary, FCC, Attachment, at 24 (Jan. 29, 2002).

[19] *Id.* at 31-32.

adjacent-band interference from independent terrestrial operations, let alone proposed any measures at all. This complete lack of record evidence strongly suggests that no effective measures in fact exist, short of imposing significant operational restrictions that would destroy the commercial viability of any system.

2. Band Sharing Will Force Trade-offs That Will Severely Restrict the Operations of Either or Both MSS and Terrestrial Services

As discussed in Section I(A) above, in order to protect co-frequency 2 GHz MSS from harmful interference, a stand-alone terrestrial system would be required to operate under significant technical constraints, which effectively would limit dramatically the number of terrestrial UTs that could be supported. Even if, however, certain technical standards or protocols were attempted to allow the stand-alone terrestrial system to support additional terrestrial UTs, these protocols would merely impose additional, fixed constraints on the transmission parameters under which co-frequency 2 GHz MSS systems operate. These constraints may include limiting the pool of available frequencies and decreasing the sensitivity of satellite and UT receivers to signals from terrestrial UTs. Many of these restrictions and modifications also would be totally inappropriate for 2 GHz MSS systems already deployed or in an advanced stage of deployment. Requiring 2 GHz MSS systems to operate under these fixed constraints effectively would reduce the available system capacity so as to destroy the viability of their services. Simply put, a trade-off would be required in order to permit a stand-alone terrestrial operator to increase its system capacity beyond a marginal level. This trade-off could be achieved only at prohibitive and unreasonable costs to 2 GHz MSS incumbents sharing the same frequencies.

Regardless of whether protocols could be implemented to permit expanded services by a stand-alone terrestrial system, the mere existence of such a system would force co-frequency 2 GHz MSS operators to consider additional, cost-prohibitive measures to protect the integrity of their systems. Specifically, 2 GHz MSS operators would be compelled to re-engineer their systems to make them less susceptible to interference from terrestrial systems. It is doubtful that ICO in particular could feasibly implement any such re-engineering at this advanced stage in the deployment of its system. Moreover, since 2 GHz MSS operators would have no knowledge or control of the actual operations of independent terrestrial systems, they would be forced to operate under much more conservative technical parameters, effectively limiting their system capacity and restricting the scope of their operations.

III. Conclusion

The record is replete with technical evidence demonstrating the infeasibility of band sharing between 2 GHz MSS and independent terrestrial operations, as well as the devastating impact of band sharing upon the viability of both operations. On the other hand, the public interest in the prompt deployment of ATC-integrated 2 GHz MSS is readily apparent. Accordingly, ICO urges the Commission to authorize ATC use in the 2 GHz MSS band without further delay.

Respectfully submitted,

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March 22, 2002

CERTIFICATE OF SERVICE

I, Gwendolynne M. Chen, do hereby certify that I have on this 22nd day of March, 2002, had copies of the foregoing **SUPPLEMENTAL COMMENTS OF ICO GLOBAL COMMUNICATIONS** delivered to the following via electronic mail:

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Washington, D.C. 20554

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